Remarks/Arguments

Amendments

Claims 16-21, 23-24, and 33 have cancelled. Claim 22 has been amended to recite that the ceramic material is Al_2O_3 and that the lithium salt is $LiPF_6$. Support for this amendment is found in Example 8. Claims 25 and 33 have been amended to change dependency. Grammatical amendments have been made to claims 33 and 36. Support for newly presented claims 37 and 38 is found in Example 8, page 15, line 395, to page 17, line 439. It is submitted that no new matter is introduced by these amendments and new claims.

Claims under Prosecution

Independent claim 22 and claims 25, 33, and 36-38, dependent thereon, remain in the application. Independent claim 22 is drawn to a non-aqueous lithium secondary battery. The battery comprises a positive electrode, a negative electrode, a microporous polymer film separator between the electrodes, and a nonaqueous electrolyte solution comprising a nonaqueous solvent and a lithium salt as defined by the claim. The negative electrode comprises ceramic particles as defined by the claim.

Claim 22, the only independent claim remaining in the application, has been amended to recite that the ceramic particles are Al_2O_3 particles, and the lithium salt is $LiPF_6$.

Independent claim 16, which recited " a gel polymer electrolyte comprising polymer and an organic electrolyte solution dissolving a lithium salt" has been cancelled.

First Rejection under 35 USC 103

Claims 16-18, 22-25, 33, and 36 were rejected as unpatentable over JP 8-321301 (JP '301) in view of Nagasubramanian, U.S. Patent 5,599,355 ('355).

This rejection should be withdrawn for the following reasons.

1. The Examiner has not made the *prima facie* case

JP '301 discloses a secondary lithium batter. Title. An additive powder is added to the active material of the negative electrode. JP '301, ¶ 0006. Alumina powder, diamond powder,

boron nitride powder, boron carbide powder, and titanium carbide powder are mentioned. JP '301, ¶ 0007. The additive powder is included to prevent the drop of the active material from the current collector. JP '301, ¶ 0007. The effect is a purely physical effect, the additive powder partially sinks into the current collector and increases the contact area between the active material layer and the current collector. JP '301, ¶ 0013. JP '301 does not disclose anything about lowering the internal resistance of the electrode by adding ceramic particles to the electrode.

In Example 1-6, alumina particles of 3 microns average particle size were used. JP '301 is otherwise silent about particle size.

The Office admits that "JP '301 does not expressly teach that the particle size of the alumina is 1 micron or less, as recited in claims 16 and 22, or that the ceramic particles are present in a ratio of between 5 and 10 parts by weight (in 100 parts of active material), as recited in claims 33 and 36." Paper 37, page 3, lines 12-14. However, the Office asserts that the particle size limitation is made obvious by the '355 patent and that the ratio is made obvious by JP '301. Each of these assertions will be addressed in turn.

Amount of Particles Added

The Office asserts that the claimed particle range would be rendered obvious by Examples in JP '301 that discloses 0.05, 1, 10, 20, and 30 weight parts of ceramic particles. Paper 37, page 4, lines 16-19. However, attention is drawn to the following passage:

> The amount of additive powder is preferably 0.01-1 part by weight, more preferably 0.05-1 part by weight to the total weight of active material. . . . [I]f the amount of additive powder is larger than 1 part by weight, not only the adhesion improvement effect in accordance with the increase of the amount cannot be obtained, but the negative electrode capacity per unit mass and unit volume is lowered.

JP '301, ¶ 0008 (emphasis added).

JP '301 teaches that negative electrode capacity is lowered by use of more that 1 part by weight of additive. This is a clear and unambiguous teaching away from applicants' invention. The range claimed in claim 22 is 5 to 20 parts by weight of the ceramic particles in 100 parts by

weight of the active substance. The person of ordinary skill in the art, having the advantage of the teachings of JP '301, would not be motivated to use more than 1 part by weight of ceramic particles. A reference that teaches away from an invention cannot make it obvious.

The Office asserts that because the batteries containing large amounts of particles are identified by the inventors as being part of the invention, the claimed range does not distinguish over the reference. Paper 37, page 5, lines 1-2.

This is a rejection under 35 USC 103, not under 35 USC 102. Therefore, the question is whether the reference makes the claimed range obvious to one skilled in the art, not whether the claimed range "distinguishes the invention from the reference." The reference clearly teaches the undesirably of using a particle size greater than 1 micron and would motive a person skilled in the art not to use particles with a particle size greater than 1 micron.

The Office also asserts that the range the range 0.01 to 1 part by weight is only a preferred embodiment of the invention disclosed in JP '301. Paper 37, page 6, lines 9-11. The question is not whether or not this range is a preferred embodiment or whether the range greater than 1 micron is part of the invention. The question is, "What does JP '301 teach to one skilled in the art?" The reference clearly teaches the undesirably of using a particle size greater than 1 micron and would motive a person skilled in the art not to use particles with a particle size greater than 1 micron.

Particle Size

The '355 patent discloses a composite solid electrolyte formed by dissolving a lithium salt, such as lithium iodide, in a mixture of a first solvent, which is a cosolvent for both the lithium salt and a binder polymer such as polyethylene oxide, and a second solvent, which is a solvent for the binder polymer and has poor solubility for the lithium salt. Reinforcing filler such as alumina particles are then added to form a suspension followed by the slow addition of binder polymer. '355 patent, Abstract. Particle sizes of 0.05 micron and 0.3 micron are exemplified. '355 patent, column 6, lines 5-29.

The Office relies on the following statement: "Both the transport number and ionic conductivity are influenced by the particle size of alumina." '355 patent, column 7, lines 35-37.

The "transport number and ionic conductivity" of what? The sentence does not say. This can only be determined by reading the sentence in context. The paragraph in which this statement appears is as follows:

> The method of the invention permits formation of uniform films of CSE with excellent mechanical properties. The composite solid electrolyte (CSE) prepared by the method of the invention exhibits the highest transport number reported yet for a polymeric electrolyte for Li^+. The conductivity of the CSE at 103°C is 10^{-4} mho cm^{-1}. Both the transport number and ionic conductivity are influenced by the particle size of alumina. Thermal creep measurement studies show that the CSE is much more dimensionally stable than the PEO/LiI electrolyte.
>
> '355 patent, lines 30-40 (emphasis added).

When the sentence is read in context, it is apparent that the "what" whose "transport number and ionic conductivity are influenced by the particle size of alumina" is the composite solid electrolyte prepared by the method of the invention. The composite solid of the electrolyte contains a binder polymer, a lithium salt, a first solvent that that is a cosolvent for the lithium salt and the binder polymer, and a second solvent that is a solvent for the binder polymer and has low solubility for the lithium salt. '355 patent, claim 1. Lithium salt coated particles are formed. *Id.*, lines 13-15.

The Office asserts that the '355 patent teaches that particle size is a "result effective variable." With respect to the assertion that this is a general teaching, this assertion is respectfully traversed. As shown above, the '355 patent may teach that particle size is a "result effective variable" with respect the to the invention and the combination of solvents and other materials disclosed therein, but this is not a general teaching, applicable to all situations, particularly to the addition of particles to negative electrode.

In applicants' invention, the particles are added to the negative electrode, not to a composite solid electrolyte. Further, applicant's invention, as recited in claim 22, does not comprise a solid electrolyte. The '355 patent discloses nothing about the addition of alumina particles to a negative electrode.

Conclusion

The Office admits that two limitations recited by claim 22, particle size and the amount of particles added are not disclosed by the primary reference, JP '301. As discussed above, neither of these limitations are made obvious by the applied references. The Office has not made the *prima facie* case. Combination of the references in the manner indicated by the Office does not produce applicants' invention. The rejection of claims as unpatentable over JP '301 in view of the '355 patent should be withdrawn.

2. The invention is unexpected in view of the teachings of the art

Applicants' claim 22 recites that the negative electrode comprises 5 to 20 parts by weight of the ceramic particles in 100 parts by weight of the active substance. As shown in Example 9 of the specification, the discharge capacity at high rates of discharge is increased by the presence of the alumina particles. Specification, page 21, lines 541-55, and Figure 9. As discussed above, JP '301 teaches that if the amount of additive powder is greater than 1 part by weight, the negative electrode capacity per unit mass and unit volume is lowered. This teaching stands on its own, apart from any question as to whether or not batteries containing these less effective electrodes are considered to be "part of the invention" disclosed in JP '301 Therefore, applicants' results are unexpected in view of the teachings of the art.

For this additional reason, the rejection of claims as unpatentable over JP '301 in view of the '355 patent should be withdrawn.

In addition, claim 22 has been amended to recite that the that the ceramic material is Al_2O_3 and that the lithium salt is $LiPF_6$. This particular combination has another unanticipated effect. HF, which has a delirious effect on the battery and cause catalyze decomposition of the solvent, can be produced by decomposition of the anion caused by trace amounts of water. It is believed that the alumina in the electrode reacts with the HF and thus prevents these undesirable reactions from occurring. For this additional reason, the rejection of claims as unpatentable over JP '3061 in view of the '355 patent should be withdrawn.

Second Rejection under 35 USC 103

Claims 19-21 were rejected as unpatentable over JP '301 in view of '355 and further in view of Andrei, U.S. Patent 5,756,231. Because claims 19-21 have been cancelled, this

rejection is moot.

Conclusion

It is respectfully submitted that the claims are in condition for immediate allowance and a notice to this effect is earnestly solicited. The Examiner is invited to phone applicants' attorney if it is believed that a telephonic or personal interview would expedite prosecution of the application.

Respectfully submitted,

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Dated: September 24, 2003

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